fresh to strong gales. By the 21st this storm had advanced to south of Newfoundland, where a loss of energy was shown, after which it moved eastward and apparently dissipated. During the 21st and 22d a storm of considerable strength moved eastward over the north part of the Gulf of Mexico, and on the 23d was central off the south and middle Atlantic coasts. During the 24th and 25th this storm moved eastward south of the 40th parallel to the 65th meridian, with pressure below 29.40 (747) and fresh to strong gales. By the 26th the storm had moved to the west edge of the Grand Banks, with an apparent increase in energy, after which it recurved northward and probably united with a storm which moved northward over Nova Scotia during the night of the 27–28th. Mr. Jos. Ridgway, jr., observer, Saint Thomas, W. I., reports, under date of the 26th, "that the barometer had been falling at Saint Thomas since the 20th, reaching the lowest point, 29.89 (759), at 5 p. m., 25th. The morning of the 24th the wind was easterly, and later in the day it veered to se., and on the 25th it veered from se. to sw. The tide had been unusually high for several days." These conditions were probably due to the storm which moved from the Gulf of Mexico along the Atlantic coast from the 21st to 26th. On the 27th a storm of considerable energy, with pressure below 29.20 (742), appeared between Nova Scotia and Bermuda, whence it moved northward to the Gulf of Saint Lawrence by the 28th, with pressure below 29.00 (737) and heavy gales, after which it disappeared north of the region of observation. During the 30th and 31st a storm moved northeastward over the Canadian Maritime Provinces and the Gulf of Saint Lawrence and disappeared north of Newfoundland, with pressure below 29.30 (744) on the 30th.

FOG IN OCTOBER.

The limits of fog-belts west of the 40th meridian, as determined from reports of shipmasters, are shown on chart I by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on 19 dates; and between the 55th and 65th meridians on 3 dates. No fog was reported west of the 65th meridian. Compared with the corresponding month of the last 3 years the dates of occurrence of fog near the Grand Banks numbered 6 more than the average; and between the 55th and 65th meridians 2 less than the average. West of the 65th meridian the average number of days for which fog was reported for the last 3 years is 3. On the dates fog was reported east of the 65th meridian it occurred with the approach or passage to the northward of general storms. Dense fog was reported at New York City on the 23d and 24th with the advance along the middle Atlantic coast of a general storm.

OCEAN ICE IN OCTOBER.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for October during the last 8 years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
October, 1883	46 56	46 22	October, 1883	46 56	46 22
October, 1884	Off Cape	Race.	October, 1884	46 56	50 55
October, 1885	48 21	47 12	October, 1885	48 21	47 12
October, 1886	41 34	49 43	October, 1886	46 03	46 37
October, 1887	42 58	50 02	October, 1887	42 58	50 02
October, 1888	51 43	55 36	October, 1888	51 43	55 36
October, 1889	44 32	49 28	October, 1889	46 30	45 59
October, 1890	44 47	49 33	October, 1890	47 56	45 45
Mean	45 55	50 11	Mean	47 10	48 33

For the current month ice was reported more than 1° south and nearly 3° east of the average southern and eastern limits of ice for October, as determined from reports of the last 7 years. The southernmost ice reported was a medium sized iceberg noted on the 13th in the position given, and the easternmost ice reported was a large iceberg noted on the 5th in the position given. The iceberg of the 5th, referred to, was east of the extreme eastern limit of ice for October as shown by reports of the last 7 years. As is usual in October ice was most frequently encountered along the east edge of the Banks of Newfoundland north of the 45th parallel, and in and east of the Straits of Belle Isle. In quantity the ice reported for the current month exceeded the average for October.

The limits of the region within which Arctic ice was reported for October, 1890, are shown on chart I by ruled shading.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

Many of the voluntary stations do not have standard thermometers or shelters.

The distribution of mean temperature over the United States and Canada for October, 1890, is exhibited on chart II by dotted isotherms. In the table of Signal Service data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

The mean temperature was highest over south Florida and in the lower Rio Grande valley, where it was above 75, and the mean values were above 70 over the Florida Peninsula, along the west Gulf coast, and in the lower Rio Grande valley. South of a line traced from the South Carolina coast irregularly westward to central Texas, and thence southwestward to the middle Rio Grande valley, over the southwest part of the southern plateau, in southern California, and at stations in the San Joaquin and Sacramento valleys the mean temperature was above 65. The mean temperature was lowest at elevated stations in central Colorado, where it was below 35, and the mean readings were below 40 in the lower Saint Lawrence valley, in extreme northwest Michigan, northeast Minnesota, and in the Saskatchewan Valley.

The mean temperature was above the normal over the northern portion of the country from east Washington to the Gulf of Saint Lawrence, along the Pacific coast south of the 40th parallel, over the southwest part of the plateau region, on the southeast slope of the Rocky Mountains, in the lower Rio Grande valley, and over south Florida; elsewhere the month was cooler than usual. The greatest departures above the normal temperature were noted in Manitoba and on the south Pacific coast, where they ranged to 4.7 at Minnedosa, Man., and to 4.8 at Los Angeles, Cal. The most marked departures below the normal temperature were reported in the interior of Alabama and Georgia, and in eastern Tennessee, where they equalled or exceeded 3.0.

The warmest October along the middle and south Atlantic coasts and in Florida occurred in 1881, when the mean temperature was 3 to 5 above the normal; from the northeast and middle-eastern slopes of the Rocky Mountains eastward over the Ohio Valley, the Lake region, New York, and New England, in 1879, when the mean temperature was 4 to 8 above the normal; from the Dakotas westward to the north Pacific coast in 1889, when the mean temperature was 4 to 6 above the normal; along the middle Pacific coast in 1887, when the mean temperature was 3 to 4 above the normal; and at Los Angeles, Cal., in 1890, when the mean was 4.8 above the normal and 1.5

above the highest mean previously reported for October. The coolest October over a greater part of New England and southeast New York occurred in 1888, when the mean temperature was 2 to 5 below the normal; along the middle and south Atlantic coasts in 1876, when the mean temperature was 6 to 7 below the normal; over the east part of the lower lake region in 1889, when the mean temperature was about 5 below the normal; in the valley of the Red River of the North, at Lake Superior stations, in northeast Iowa, and on the Texas coast in 1887, when the mean temperature was 4 to 6 below the normal; in the middle Mississippi and lower Missouri valleys in 1873, when the mean temperature was 5 to 7 below the normal; from the upper Missouri valley westward to the north Pacific coast and thence southward along the Pacific coast to the 35th parallel in 1881, when the mean temperature was 3 to 5 below the normal; over the plateau region south of the 40th parallel in 1883, when the mean was about 5 below the normal; and on the south Pacific coast in 1886, when the mean temperature was 3 to 4 below the normal. From the above it will be noted that in 1881, when the mean temperature was the highest ever recorded for October along the middle and south Atlantic coasts, the month was the coolest October on record from the upper Missouri valley to the north Pacific coast and thence southward along the Pacific coast to the 35th parallel, and that in 1889, when the month was unprecedentedly warm from the upper Missouri valley to the north Pacific coast, the month was the coolest October ever noted at stations in the east part of the lower lake region.

DEVIATIONS FROM NORMAL TEMPERATURE.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for October for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for October, 1890; (4) the departure of the current month from the normal; (5) and the extreme monthly mean for October, during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1890.	(4) Departure from normal.	(5) Extreme monthly mean for Oct.			
						Highest.	Year.	Lowest.	Year.
Arkansas.		°	*Years*	°	°	°		°	
Lead Hill	Boone	60.1	9	59.9	— 0.2	64.0	1881	56.0	1885
California.									
Sacramento	Sacramento	61.7	37	53.9	— 7.8	69.9	1875	53.9	1890
Connecticut.									
Middletown	Middlesex	50.0	23	49.1	— 0.9	54.7	1871	45.5	1888
Florida.									
Merritt's Island	Brevard	75.7	8	75.5	— 0.2	79.0	1882	73.1	1885
Georgia.									
Forsyth	Monroe	67.3	16	64.7	— 2.6	75.4	1884	61.7	1885
Illinois.									
Peoria	Peoria	53.9	31	54.7	+ 0.8	62.7	1879	45.2	1869
Riley	McHenry	47.7	34	48.9	+ 1.5	56.0	1879	38.6	1869
Indiana.									
Vevay	Switzerland	55.9	24	56.4	+ 0.5	65.0	1879	43.2	1869
Iowa.									
Cresco	Howard	45.8	18	44.9	— 0.9	54.1	1879	41.2	1873
Monticello	Jones	49.0	35	48.0	— 1.0	58.0	1879	36.0	1873
Logan	Harrison	52.6	16	53.8	+ 1.2	60.7	1879	48.5	1875
Kansas.									
Lawrence	Douglas	54.4	22	54.8	+ 0.4	60.5	1879	44.0	1869
Wellington	Sumner	56.6	11	60.1	+ 3.5	60.6	1879, '84	53.3	1880, '83
Louisiana.									
Grand Coteau	Saint Landry	68.7	9	66.8	— 1.9	75.5	1883	64.8	1885
Maine.									
Orono	Penobscot	45.6	20	45.5	— 0.1	49.7	1879	42.1	1888
Maryland.									
Cumberland	Allegany	50.8	31	52.7	+ 1.9	60.0	1881	41.8	1869
Massachusetts.									
Amherst	Hampshire	48.8	54	48.1	— 0.7	56.0	1879	42.8	1841
Newburyport	Essex	49.4	12	48.5	— 0.9	55.0	1879	45.1	1888
Somerset	Bristol	52.5	18	51.5	— 1.0	58.1	1879	47.6	1874
Michigan.									
Kalamazoo	Kalamazoo	49.8	14	51.0	+ 1.2	54.5	1879	45.7	1887
Thornville	Lapeer	50.4	13	50.0	— 0.4	58.5	1879	45.6	1889
Minnesota.									
Minneapolis	Hennepin	45.3	25	44.5	— 0.8	56.1	1879	36.5	1869
Montana.									
Fort Shaw	Lewis & Clarke	49.0	21	49.1	+ 0.1	58.1	1879	34.6	1881
New Hampshire.									
Hanover	Grafton	44.9	55	44.6	— 0.3	52.4	1879	38.6	1836

Deviations from normal temperature—Continued.

State and station.	County.	(1) Normal for the month of Oct.	(2) Length of record.	(3) Mean for Oct., 1890.	(4) Departure from normal.	(5) Extreme monthly mean for Oct.			
						Highest.	Year.	Lowest.	Year.
New Jersey.		°	*Years*	°	°	°		°	
Moorestown	Burlington	53.4	27	53.6	+ 0.2	59.5	1879	48.6	1888
South Orange	Essex	52.8	20	51.4	— 1.4	58.1	1879	47.2	1871
New York.									
Cooperstown	Otsego	46.4	36	45.5	— 0.9	53.3	1879	40.7	1865
Palermo	Oswego	47.0	30	47.9	+ 0.9	53.9	1879	41.8	1889
North Carolina.									
Lenoir	Caldwell	56.7	19	55.0	— 1.7	66.4	1878	48.0	1874
Ohio.									
N'th Lewisburgh	Champaign	51.9	58	53.2	+ 1.3	58.0	1852	43.0	1869
Wauseon	Fulton	50.4	20	50.1	— 0.3	59.0	1879	45.2	1889
Oregon.									
Albany	Linn	52.2	10	51.0	— 1.2	56.3	1885	48.7	1881
Eola	Polk	51.6	19	50.0	— 1.6	59.7	1876	45.4	1873
Pennsylvania.									
Dyberry	Wayne	46.5	22	45.8	— 0.7	53.4	1879	41.2	1869
Grampian Hills	Clearfield	47.7	26	48.2	+ 0.5	56.4	1879	39.2	1869
Wellsborough	Tioga	50.2	11	46.5	— 3.7	60.0	1880	41.2	1889
South Carolina.									
Statesburgh	Sumter	63.6	9	61.7	— 1.9	69.0	1881	59.8	1885, '88
Tennessee.									
Austin	Wilson	59.5	21	58.2	— 1.3	70.2	1879	52.5	1888
Texas.									
New Ulm	Austin	69.7	17	69.4	— 0.3	73.9	1881	65.8	1873
Vermont.									
Strafford	Orange	46.8	17	45.6	— 1.2	52.8	1879	40.6	1888
Virginia.									
Birdsnest	Northampt'n	61.0	22	55.9	— 5.1	69.2	1881	54.5	1869
Washington.									
Fort Townsend	Jefferson	50.6	14	49.6	— 1.0	54.6	1875	48.6	1879
Wisconsin.									
Madison	Dane	47.9	21	48.2	+ 0.3	59.4	1864	39.8	1869

MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperature reported by a regular station of the Signal Service was 99, at Los Angeles, Cal., on the 21st and 27th. The maximum temperature rose to or above 90 in central and northeast Florida, in the Rio Grande Valley, in the Colorado Valley from extreme south Nevada southward, in California south of the 35th parallel, and at Red Bluff, Cal. The maximum temperature was above 80 north of a line traced from the Virginia coast to Lake Erie, thence westward to the lower Missouri valley, thence northward over the Dakotas, thence southward to south New Mexico, thence westward to central Arizona, and thence northwestward to northern California. The lowest maximum temperature was noted on the north Pacific coast and over the northern plateau, where it fell below 70. The reports of United States Army post surgeons and voluntary observers show that the maximum temperature rose to or above 100 at the following-named stations only: Merced, Cal., 118, and Casa Grande and Gila Bend (2), Cal., 100. At Galveston, Tex., 20 years record, the maximum temperature was 2 higher than previously reported for October, noted in two or more preceding years, and at Springfield, Ill., 12 years record, the maximum temperature was as high as previously reported for October, being the same as for 1879.

The lowest temperature reported by a regular station of the Signal Service was 14, at Huron, S. Dak., on the 26th. The minimum temperature was below 30 north of a line traced from the New England coast over the lower lake region, thence northwestward over lower Michigan, thence southwestward to the south part of the southern plateau, thence northwestward to west central Oregon, and thence northward (describing a loop to the eastward over the Columbia Valley) to British Columbia. The highest minimum temperature was 64, at Key West, Fla., and the minimum values were above 50 along the immediate west Gulf coast. At Key West, Fla., the minimum temperature was 1° lower than previously reported for October. The reports of United States Army post surgeons and voluntary observers show the following minimum temperatures in states and territories where temperature falling to or below 20 was reported: Breckenridge, Colo., —10; Alliance, Nebr., and Pioche, Nev., 8; Lakin, Kans., 15; Howard, S. Dak., Alta, Utah, and Henry's Lake, Idaho, 10; Fort Logan, Mont., Steele, N. Dak., and North Powder, Oregon, 11; Pokegama Falls,

Minn., and West Milan, N. H., 12; Dale Enterprise, Va., and Camp Pilot Butte, Wyo., 13; Stilson, Iowa, 15; Waterville, Wash., and Haywood, Wis., 16; Chama, N. Mex., 17; Adrian, Mo., 18; Atwood and Sandwich, Ill., Point Isabel, Ind., Fairfield, Me., and East Berkshire, Vt., 20.

LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather are shown on chart II by a line traced from the middle New England coast over the lower lakes, thence to the middle Ohio valley, thence southeastward to north South Carolina and Georgia, thence westward over the south part of the southern plateau, thence northwestward to west-central Oregon, thence eastward over the valley of the Columbia River, thence westward to west-central Washington, and thence northward to British Columbia.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature are given in the table of Signal Service data. The greatest monthly ranges of temperature occurred in the middle Missouri valley, where they exceeded 60, whence they decreased eastward to less than 30 on the south New England coast, southeastward to less than 25 over extreme south Florida, and to less than 40 on the immediate east Gulf coast, southward to 40 on the west Gulf coast, southwestward to less than 50 over the southern plateau and on the south Pacific coast, and westward to less than 40 on the middle Pacific coast, and to less than 30 at stations on the north Pacific coast.

FROST.

The first killing frost of the season was reported as follows: 3d, Carson City, Nev. 5th, Fort Morgan and Magnolia, Colo.; Moab, Utah. 7th, Fort Stanton, N. Mex. 8th, Watkins, Colo. 9th, Roseburgh, Oregon. 10th, Albany and McMinnville, Oregon; Keeler and Susanville, Cal.; Eastport, Me. 11th, Tatoosh Island, Wash.; Walnut Grove, Ariz. 12th, Fort Apache, Whipple Barracks (Prescott), and Holbrook, Ariz.; Glendive, Mont. 13th, Strawberry, Ariz.; Santa Fé, N. Mex. 14th, Cañon City, Hugo, Lamar, Yuma, and Pueblo, Colo.; Dodge City and Wichita, Kans.; Springfield, Mo. 15th, Deer Trail, Colo.; Lunenburgh, Vt. 16th, Sheridan Lake, Colo. 17th, Centreville and Ironton, Mo. 18th, Bennet, Colo.; New Frankfort, Mo. 19th, Keokuk and Clarinda, Iowa; Kansas City, Excelsior Springs, and Wither's Mills, Mo.; Howe, Nebr. 20th, Springfield, Louisville, Oswego, and Riley, Ill.; Clinton and McCausland, Iowa; Shelbyville, Ky.; Trenton, Tenn. 21st, Forest Park (Saint Louis), Mo.; Indianapolis and Seymour Ind.; Toledo, Napoleon, Tiffin, and Wauseon Ohio; Detroit, Mich.; Marion and Wytheville, Va.; Morganton and Lenoir, N. C.; Portland, Me. 22d, Boston and Fall River, Mass.; Albany, N. Y.; Cleveland, Sandusky, Garrettsville, Orangeville, and Vienna, Ohio; Lava, N. Mex. 23d, Brady, Tex. 26th, Topeka, Kans. 27th, Hot Springs, Osceola, and Winslow, Ark.; Newnan, Ga.; Marksville La.; Meridian and Hernando, Miss.; Saint Louis, Lebanon, and Willow Springs, Mo.; Leavenworth, Lebo, and Morse, Kans.; Chicago, Ill.; Shiloh, Ohio. 28th, Louisville, Ky.; Vaiden, Miss.; Raleigh, Chapel Hill, Mount Pleasant, and Washington, N. C.; Columbia and Statesburgh, S. C.; Athens, Ga.; Chattanooga, Nashville, Cumberland Gap, Andersonville, Jacksboro, Parksville, Nunnelly, Austin, and Hohenwald, Tenn.; Nottoway C. H., Va. 30th, Vevay, Ind.; Lexington, Ky.; Kenton and Wooster, Ohio; Oak Ridge, N. C.; Dale Enterprise and Summit, Va.; Ogdensburgh, N. Y. 31st, Montgomery and Columbiana, Ala.; Atlanta and Athens, Ga.; Agricultural College, University, Batesville, Palo Alto, Pontotoc, and Holly Springs, Miss.; Memphis, Ashwood, Dyersburgh, Covington, Grand Junction, Milan, Florence Station, Franklin, and Clarksville, Tenn.; Canton, Ky.; Cairo, Ill.; Amana, Iowa; Globe, Kans.; Jacksonborough, Ohio; Pittsburgh, Pa.; Washington City; Baltimore and Barren Creek Springs, Md.; Egg Harbor City and Readington, N. J.; Bolar, Lexington, and Staunton, Va.; New York City.

The first black frost of the season was reported at Olympia, Wash., on the 9th; at Tatoosh Island, Wash., on the 13th; at Santa Fé, N. Mex., and near Leavenworth Kans., on the 14th; at Wichita, Kans., on the 16th; at Erie, Pa., Grand Haven, and Port Huron, Mich., on the 22d; at Kansas City, Mo., on the 27th; at Knoxville, Tenn., on the 28th; at Milwaukee, Wis., on the 30th; and at Nashville, Tenn., on the 31st.

Compared with the average date of first killing frost in the respective localities the killing frost of the 14th at Springfield, Mo., and of the 31st at Atlanta, Ga., was about seasonable; that of the 9th at Roseburgh, Oregon, was about 3 weeks early; that of the 14th at Dodge City, Kans., and of the 27th at Hot Springs, Ark., was about one week late; that of the 28th at Columbia, S. C., Chattanooga and Nashville, Tenn., and of the 31st at Cairo, Ill., was about two weeks late; that of the 21st at Indianapolis, Ind., of the 27th at Saint Louis, Mo., and Leavenworth, Kans., and of the 31st at Baltimore, Md., and Washington City was about 3 weeks late; and that of the 28th at Louisville, Ky., and of the 30th at Dale Enterprise, Va., was about 4 weeks late.

Frost occurred as far south as the north part of the Florida Peninsula on the 28th; in extreme west Florida on the 20th, 24th, 27th, and 31st; in extreme south Mississippi on the 27th and 31st; in extreme south Louisiana on the 27th to 29th and 31st; in central Texas on the 5th, 6th, 10th, 23d, 24th, and 31st; to south New Mexico on the 4th, 7th, 13th, and 22d; in south-central and southeast Arizona on the 11th to 15th and 20th; and in the neighborhood of Los Angeles and San Diego, Cal., on the 10th and 11th.

Compared with September, 1890, the limit of frost was about 5° farther south in the Atlantic coast states; 7° to 8° farther south in the Mississippi Valley; and about 5° farther south in the plateau region and on the Pacific coast.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for October, 1890:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
	°	°	°	°	°
Boston, Mass	58.6	47.9	10.7	53.9	51.0
Canby, Fort, Wash	54.1	51.3	2.8	52.6	52.4
Charleston, S. C	78.1	67.5	10.6	73.3	67.6
Eastport, Me	51.6	49.1	2.5	50.4	46.6
Galveston, Tex	82.0	65.0	17.0	73.9	72.0
Key West, Fla	87.0	74.5	12.5	83.3	79.6
Portland, Oregon	61.8	52.8	9.0	55.8	52.6

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for October, 1890, as determined from the reports of nearly 2,000 stations, is exhibited on chart III. In the table of Signal Service data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest monthly precipitation reported was 14.80, at